The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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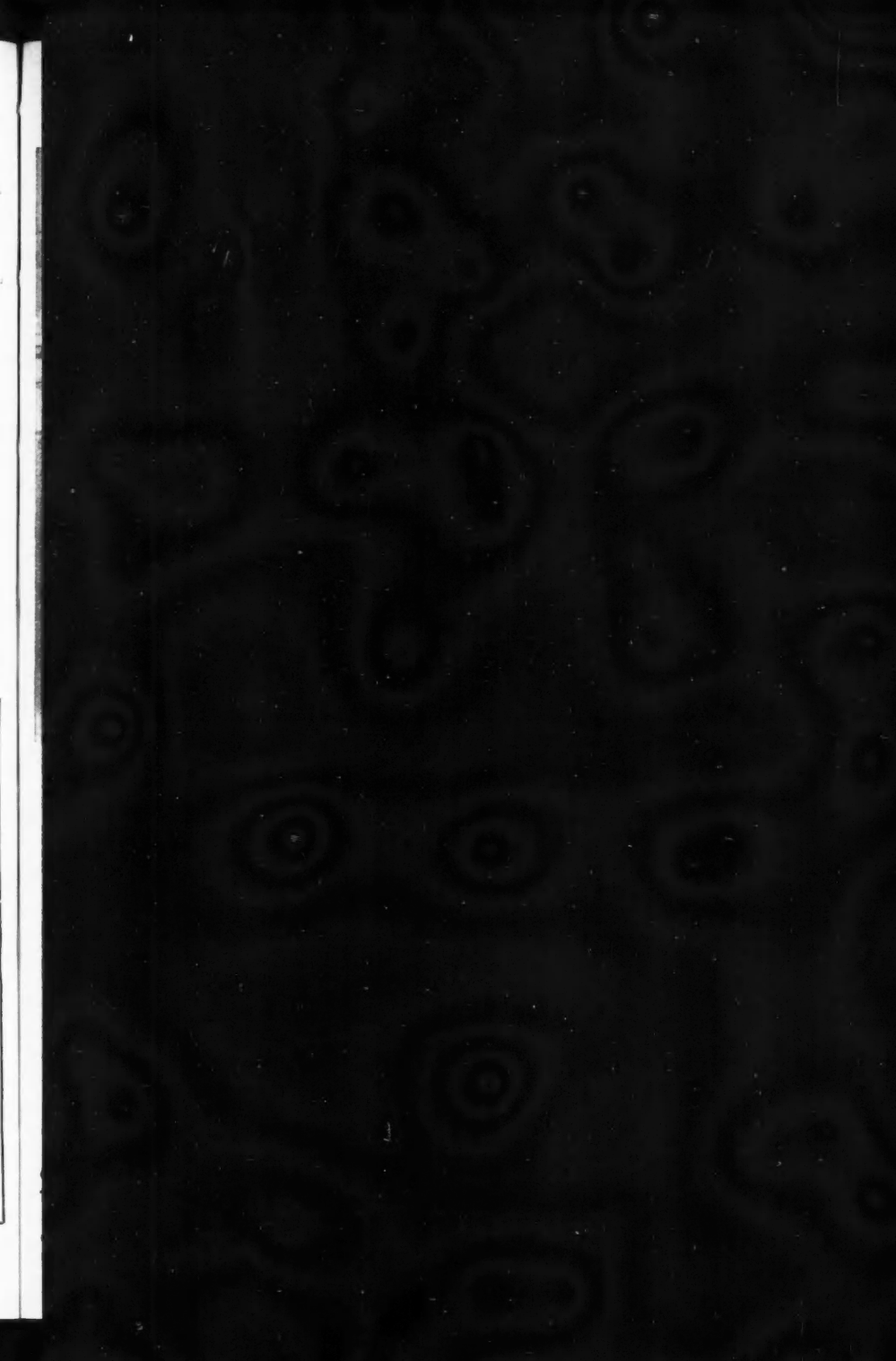

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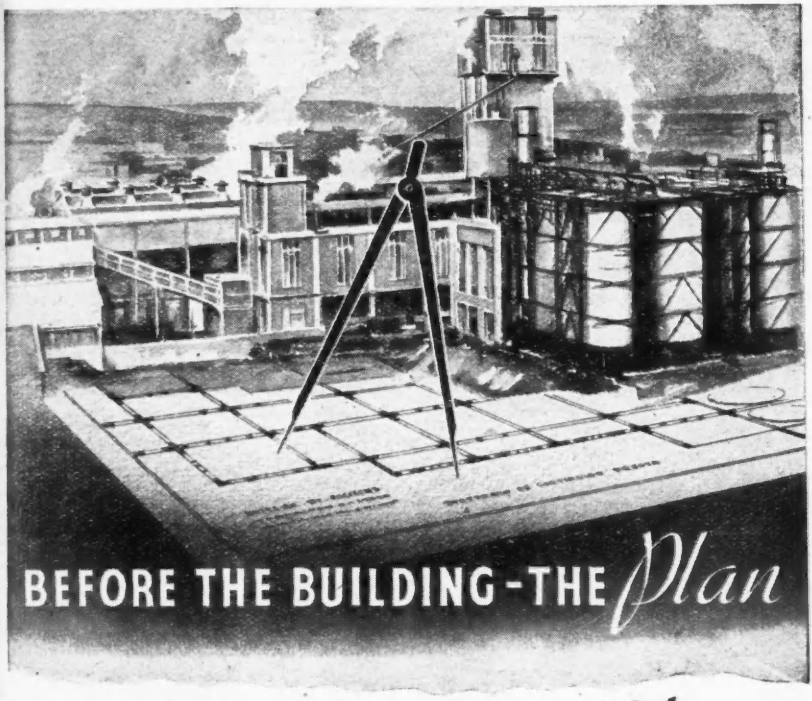

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The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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Competition

IT has been said that lack of imagination has always been the chief cause of the slowness of the progress of mankind. Imagination is often best exercised in asking oneself whether those things that appear established and permanent are in fact the best that can be done. Every state of affairs must have seemed good to the majority of those who were associated with it. Who in the Middle Ages had the imagination to foresee the roads of the 20th century? What traveller by post-horse or chaise of a later age could envisage the railway or the aeroplane? How could the recipients of the few and tardy letters of 200 years ago have foretold the telephone or the wireless? The answer is that one or two in a generation did foresee possibilities, though with no likelihood of putting their visions into practice; but the great mass of people sincerely believed that the established order was so good that it should not be disturbed. Every great discovery before the 20th century has had to pass through a stage of opposition. To-day, perhaps for the first time in history, new ideas are discussed with an open mind, and mankind, so far from being suspicious of new things, is searching actively for a new order of civilisation that will enable our pursuits to fit into the quickened tempo or research and discovery and so to avoid the catastrophes which (like the two wars and the one peace of our generation) will surely overtake us again and again if we fail.

In pursuance of this spirit of questioning, we propose to ask a question that to many must seem revolutionary indeed. It is: "Is competition necessary as a principle of business?" There are some among the older generation who look with dismay on the modern development of collaboration between business rivals. Trade Asssociations have evidently come to stay, but how far should business rivals pool their knowledge of markets, processes, patents, and so forth, and how far should they retain the "sturdy individualism" of their Victorian ancestors? We have heard every shade of opinion—from those who believe that competition will be on a national scale and that all the concerns in each nation should pool their ideas and experience for the greater well-being of national industry, to those who will have no truck with co-operation in any form. It is agreed by most people that competition of the

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right kind is an excellent thing. It is noted that the Russians, after abolishing competition, found that in both peace and war some form of special rewards for meritorious service, discoveries, inventions, trading ability, and so forth was good and accordingly re-established the system. Mankind being so constituted that cupidity, lust for glory or honours, or fear of punishment is generally necessary as a spur to action, has found it necessary to keep these incentives.

But mark how the opinion of the world has changed within 100 years or so! A century or so ago, free competition was the established order. The plight of the common man under that order was terrible. It was regarded as a law of human nature that human beings should compete with each other for possession of as much as possible of the world's money and that the Devil should take the hindmost, the hindmost being the poor and their starving children. Some of those now living have seen the out-of-works of that order of society search for crusts in the gutter. Here is a passage from a recent writer on that period: "I do not suppose there were ever such immoral economic theories before as those that prevailed among nominally Christian men during a large part of the 19th century. There was no justification for them in any part of the Old or New Testament. . . . Children in mines led lives more miserable than negro slaves. Factories were hells in which less care was taken of human beings than of machinery. And all this in the name of an Economic Law, supposed to be as inevitable as the law that governs the movement of the planets. . . . People said to each other: 'Competition is the life of trade,' as though a disgraceful scramble for the good things of life were the only way to produce an ideal society." We have gone a very long way from that state of affairs. We do not mean the same thing by competition now as our fathers did then. So far was the theory pressed in those days that many held that to give a penny to a beggar was to do an injury to society. Old Age Pensions were regarded as pernicious because they might undermine the spirit of self-help among men earning perhaps 15s. or 20s. a week. That was competition gone mad, but it was accepted as the established order. To-day, there would be no fundamental objection on the part of many economists and business men to such a form of trade regulation as would enable trade secrets and experience to be shared, the orders to be placed in some form of allocated rotation, and industries to work as units not individuals. It could be well imagined, for example, that there might be a world demand for x tons of aniline; that this x tons would be divided by international agreement between the countries that produced aniline and that each country's quota would be re-allocated among the firms in that country who were registered as producers of aniline. We do not say that this is immediately likely, but it is not an impossible state of affairs as the world develops. The change would at least be no greater than those of the last 100 years. The most important objection would be the one so frequently raised to-day—that competition is essential to progress. It is argued that without competition and with a sharing of secrets and discoveries all incentive to progress would vanish.

While there is much to be said for this view, is it likely to remain true? Should we be happy in a dead world without competition? Frankly, and as now constituted, we are of the opinion that some form of competition is still the spice of life. But is it true that without competition technical progress would cease? The answer to that depends upon the essential quality of our engineers and chemists. It is arguable that any technical man who can make an important contribution to progress will do so whether he has the incentive of personal gain or not. The interest that technical men generally take in their work is not measured in terms of additional rewards, though not unnaturally rewards are welcome. One can foresee that at some future period we may be able to do without competition, but it seems almost inevitable that there must be competition to keep up the rate of progress. It may not be the type of competition that we are accustomed to; we have seen already that our conceptions of what is meant by competition have changed out of all recognition within the past century. They will probably continue to change.

NOTES AND COMMENTS

War Against Science

IF there is any doubt remaining in the minds of our leaders, as to the value to the State of scientific knowledge, the action of the Germans in the Ukraine and Western Russia should finally remove it. The President of the Faraday Society, Dr. E. K. Rideal, has written a letter to *The Times* recording the reception of a message from the Academy of Sciences of the U.S.S.R. and the Ukrainian Academy, containing a report of the outrages committed against all scientific activities there by the invading Germans. Reports from academicians, actual eye-witnesses of the destruction, give detailed accounts of the wrecking and looting of institutes, libraries, and laboratories, and the shooting, or murder by starvation, of their professors. It further appears that German scientists and medical workers are participating in these atrocities. Part of Germany's avowed policy is the lowering of the intellectual standard of all peoples outside the *Herrenvolk*, and it is obvious that the Nazi authorities regard the elimination of all traces of scientific culture as a short cut to this goal. When the war is over, it is probable that there will be in this country a number of redundant war plants and laboratories. Not the least important part of the work of rehabilitation in the occupied countries will be the re-establishment of scientific education, and it is to be hoped that the authorities will have this in mind when disposing of surplus equipment from our war plants. It might even be a good and encouraging idea to make some official announcement in advance of our intentions in this direction.

Raw Materials Misused

LISTENING to last Sunday's broadcast of Henrik Ibsen's bitter indictment of parochial meanness and corruption, ironically entitled *An Enemy of the People*, we reflected that public consciousness of advantage had gained something from the educative influences of the last half-century. Few municipalities would be so purblind to-day as to ignore a warning as plain as that uttered by Ibsen's medical officer. But there are other directions in which short-sightedness is still refusing to see the red light, and one of these is the proper utilisation of the raw materials with which our land is endowed. We therefore welcome every blow in the campaign against waste, old-fashioned methods, and misuse. An organisation that has been most vigorous in the fight is the Scottish Reconstruction Committee, whose periodical memoranda are causing some dismay in the camp of the enemies of progress. They have already stigmatised the idiocy of hauling limestone from Derby to Aberdeen, when there is good stone to be ground on the spot; and now, in their second bulletin, *The Raw Materials of Scotland*, by Dr. A. Lamont and Mr. R. H. S. Robertson (*Quarry Managers' J.*, Dec., 1943), they point out the neglect of the alkali felspar and other sources of potash in Scotland. As the authors say, there is a shocking ignorance, in all walks of life, of what geologists and mineralogists can tell us, and the appeal for a proper survey of Scottish raw materials in a perfectly reasonable one.

Scottish Felspar

OUR raw materials should not be considered merely as war-time substitutes for imported goods, but as a foundation for the making of entirely new products. The non-metallic minerals, especially, demand further study. Of Scottish felspar specifically, there are extensive deposits in the Highlands, most of them of a quality suited to all the commercial uses of felspar, and situated within easy distance of sea transport. Moreover, with the passing of the Scottish Hydro-Electric Power Bill, a source of power for the separation processes needed to develop the potash content for use as a fertiliser is ready to hand. It is a fair criticism of our accustomed methods of dealing with raw materials to say that we have considered each of them as a source of one product only; yet elsewhere attempts are made to create wealth from all the constituents. Thus, say the authors, "Felspar should be considered not only as a source of potash, but as a possible source of alumina and silica gels, or a raw material for cement, lime-silica bricks, sodium silicate, abrasives, adsorbents,

catalysts, water-softeners, ultramarine, and so on." This is an impressive list; and we have a long way to go before we can hope to develop our raw materials so fully. Still, Sir John Orr and the food chemists have made a grand start by educating us in the proper use of foods. Must the inorganic chemists and chemical engineers lag behind in developing another source of strength, which may be less vitally important but which has the merit of being almost untapped?

A Central Research Board

THE most recent of the voices raised in the chorus demanding greater attention to industrial research is that of the London Chamber of Commerce, which has just issued a *Report on Scientific Industrial Research*, prepared by a special committee appointed last June. Although there is nothing outstandingly original in the committee's recommendations, this is perhaps just as well; for it is rather by hammering on the same note than by the enunciation of some strikingly brilliant proposition that the ponderous mechanism of modern bureaucracy is "galvanised into fruitful activity," as the Report puts it. The fundamental recommendation in the present Report is the establishment of a Central Research Board, envisaged as the focal point in the co-ordination of effort, especially towards ensuring that research demanded by public interest shall be speedily and effectively carried out. It is not always easy to decide exactly what research is thus demanded, and one of the chief difficulties ahead of all Boards of the kind suggested will always be to make decisions of this nature.

More Staff : More Money

DEALING with the universities, the recommendation is made—and a very sensible one, too—that the number of undergraduates receiving instruction should cease to be the ruling factor in deciding the size of laboratories and staff. A far larger staff should be maintained for the purpose of carrying on pure research work, and this includes a numerous body of trained laboratory technicians, whom the Report describes as the N.C.O.'s of research. The committee is far from agreeing that the sum officially apportioned to the development of technical education is adequate to the task; more money, too, will have to be raised from many sources for further research work and, where necessary, a compulsory levy on any given industry must supplement the customary grants from the D.S.I.R. to research associations. To encourage manufacturers' enterprise it is urged that the cost of pilot plant, as well as of laboratory equipment, should be made chargeable against revenue. Small and medium-sized firms must be induced to take greater advantage of the specific research work which the research associations are willing to undertake on their behalf; and the assurance to such firms that adequate facilities are available for private research, in every research association, would be among the chief functions of the Central Research Board.

Vulnerable Supplies

THE effects of economic warfare will be felt with greater intensity by Germany in the course of the next few months, for the reason that many of her vital war materials are situated on the fringes of her domain, and are liable to attack by land in the near future. The Minister of Economic Warfare at a press conference last week gave an encouraging picture. The enemy had lost Sicily, and with it her best source of rock sulphur. The Russians are approaching Nikopol, and the loss of that town and its manganese would be one of the most serious things that could happen to Germany. Nearly all Germany's molybdenum comes from the Knaben mines in Norway and from Finland; the R.A.F. has heavily bombed the Knaben workings, and the Finnish deposits are only 15 miles from the Russian front line. Seventy per cent. of her bauxite comes from the south of France, a source of supply that will be very vulnerable when we land on the Continent. In addition to all this, the Royal Navy last winter sank about three-quarters of the material which Germany was trying to bring from Japan. How great is Germany's need was shown recently, when she sent out a third of her remaining destroyer force 600 miles into the Atlantic to escort home a blockade runner; the Navy sank this ship and a large proportion of the destroyers.

I.C.I.'s War Record

Lord McGowan's Review

SPEAKING at the Glasgow Chamber of Commerce on Tuesday, Lord McGowan raised the veil on I.C.I.'s war effort. He regretted he still could not tell more than a small part of the company's manifold activities and he was only persuaded to tell that much because he was convinced that the time had come for industry to be less secretive about its achievements. The system of private enterprise, upon which Britain's national greatness had so largely been built, was under fire. There were few specific charges openly made, but a wealth of misrepresentation and innuendo designed to create the impression that existing methods of conducting industry and commerce had failed, and leading to the argument that the substitution of operation and control of industry by the State would presently usher in a new Utopia. Much of this criticism arose from ignorance, and the effective answer to it was to give facts—more especially since industry had been too prone to adopt a policy of silence. It should be the duty of industry to tell the public more about what it was doing, what it could do, and meant to do. "We owe this duty," he said "to our employees, the management and labour, who have devotedly stuck to their work during more than four years of strain and privation."

Because of its size I.C.I. was a favourite target with critics. It had now over 120,000 employees, in addition to some 15,000 on active service at home or overseas, but the peace-time personnel was far smaller—round about 70,000. If I.C.I. looked big to British eyes it was relatively small compared with great firms of the U.S.A. or Germany. The German I.G. Farbenindustrie employed about three times more people, while United States firms like United States Steel and General Motors, with over 200,000 employees each, quite dwarfed I.C.I.

Space precludes the recording of more than a brief summary of I.C.I.'s war work and only a few of the major landmarks are sketched in here. I.C.I.'s war effort started in 1935, and began with the erection, at a cost of nearly £3,000,000, of a large plant to produce petrol from British coal and tar, a decision carried in the face of strong opposition in Parliament and from the press. The next landmark in I.C.I.'s war effort was in 1937, and had to do with the manufacture of cartridge cases for artillery and small arms.

Building of Government Factories

Probably the largest and most important contribution, however, measured in terms of man-power, was the erection of factories for the production of materials necessary for war. I.C.I. had been responsible for building entirely new factories involving the expenditure of £61,000,000, to make materials of which they either had manufacturing experience or on which they had carried out research. These factories belonged to the Government, but to I.C.I. must go the credit for having built them and for operating them. Not only had I.C.I. to build the plants, but to train Government personnel to operate them. I.C.I. had also built, at Government request, a number of plants not connected in any way with the normal work of the company, a notable example being the plants recently erected for the dehydration of vegetables.

Key Men in Ministries

"Some play has been made of the number of men from I.C.I. who are found in responsible positions in the various Ministries. Why is this? Not, you may be sure, because at a time of such pressure on us we wish to lose so many of our best men. Nor, as is more fancifully suggested, because we desire, by some mysterious means, to influence Ministries in our favour, but solely because nowhere else, except in the great firms, can the State find men with the necessary ability and experience of managing large scale operations. No fewer than 2500 of our key men are in Government employ. These include three of our executive directors."

Early in the war I.C.I.'s experts had also anticipated that a shortage of animal feeding-stuffs would coincide with a large surplus of straw by developing a process to convert straw or chaff on the farm into a nourishing food for stock by soaking it in a solution of caustic soda. That process was now established on nearly 3000 farms, and the credit for developing it and introducing it on such a scale into British farm practice rested solely with I.C.I.

New Explosives

From I.C.I.'s nature, it was obvious that the brunt of supplying chemicals and explosives for the nation's war effort had to fall on it. When we heard of "block-busters" or "cookies" raining on Berlin and other German cities, we could remember that these were filled with explosives and fitted with fuses largely invented and developed by private enterprise. What needed special mention was the part that I.C.I. had played in the development and production of secret weapons, many of which naturally, were still on the secret list. The number and efficiency of these new weapons were eloquent evidence of the inventiveness which still characterised the British people, but between the invention or devising of a new weapon and its final production in huge quantities required by modern warfare, there was a wide gulf fixed. This could only be bridged by patient research, adaptation and improvement until the efficient weapon was evolved, as safe to handle as it was deadly to the enemy. In addition to weapons

and propellants which I.C.I. experts had themselves devised, I.C.I. had been entrusted by the Government with the responsibility for perfecting and producing a number of secret weapons invented by outside experts. Why had it been given this responsibility? Again only because there was no other organisation which so combined under the one direction a team of chemists, physicists, metallurgists and engineers used to working together on similar problems in the course of their peace-time duties.

The Need for Drugs

The need for large-scale manufacture of drugs and alternate specifics became, on the outbreak of war, as vital as the provision of food. A few years before the war I.C.I. had decided to enter the pharmaceutical field in a big way, as dyestuffs were, in some forms, a base for the production of drugs. When war broke out, I.C.I. had to produce—and quickly—products of which, because of war, the country would be short, In this it had been very successful. Previously, the treatment of malaria needed the natural product quinine, or the German product "Atebrin," so that when the Japanese overran the source of supply in the East Indies, the production of an efficient British specific was vital. I.C.I. had not been long in filling the gap. Whereas in 1940 it produced no more than 600,000 tablets of mepacrine, during 1944 it would produce over 1 thousand million! Lord McGowan also instanced penicillin, in the production of which I.C.I. had played and was playing a great part.

I.C.I. was proud of a discovery made at its Ardeer factory. This led to the incorporation of a chemical device in cans of soup which enabled a hot meal to be obtained within four minutes. This was in itself a small invention, but meant a great deal to troops in enemy territory and to airmen or sailors adrift at sea.

Textiles and Plastics

A number of I.C.I. inventions would have great use in peace as well as war. Some of these lay in the realm of synthetic fibres. Great strides were being made in this field, but in Britain the strain of war work had so far prevented people making as much progress as they would have liked. Lord McGowan was confident, however, that British discoveries would be of great importance to textile industries after the war. In parallel with this, I.C.I. had made progress in great Britain with the manufacture of the American-discovered nylon which had been required for war purposes. Britain could now rely on its own nylon for all its various post-war uses. This development was only one of the fruits of that agreement between I.C.I. and the great U.S. firm of Du Pont which was now under fire in the U.S.A. I.C.I. was also interested in a big way in plastics, and another I.C.I. discovery, polythene, was a new plastic material with many valuable properites. It was already being used extensively in the electrical field and in connection with submarine cables, high frequency and high voltage cables. Other uses would probably be as a bonding and finishing material for textiles, and in the manufacture of other derivatives. It was also capable of being spun into yarn. Perspex, now the standardised substitute for glass in aircraft, was another I.C.I. discovery

Lord McGowan said he could, if permitted, extend the list indefinitely. "I could tell you about developments in such different directions as perfecting means of locating airmen or seamen adrift at sea; making anti-mildew finishes for webbing equipment or fabrics used for wireless equipment; sealing compositions to make gas-tight the stitchholes in the seams of textiles; camouflage materials for such different things as army horses, aerodrome runways, or the sides of quarries; the production of synthetic flints for cigarette lighters, hitherto imported from abroad; in experiments in fish culture in Scotland and so on and so forth."

Plans for Expansion

Already great companies such as I.C.I. were considering their expansion in the years following the declaration of peace. I.C.I. had been asked by Government to do all it possibly could to ensure full employment. Plans were already laid for the expenditure of many millions of pounds over the next five years. These involved the replacement of plant worn out by continuous war pressure, extensions to existing plant, and new factories required for the manufacture of many new products which were now, after years of research and development, ready for production.

Mentioning, with justifiable pride, that throughout the war in all I.C.I.'s many factories, with their 120,000 workers, there had been no major trade dispute, Lord McGowan demonstrated how his company had aided the U.S.A. and U.S.S.R., and ended with emphasising that private enterprise had been and was capable of showing their spirit of adventure and courage on which the Empire had been built. "With our background, our scientific and technical manufacturing knowledge, and our knowledge of the world's markets, we as a company," he said, "are prepared to go ahead and to do our utmost to assist the Government in creating the World of Plenty. We believe we shall be able the more effectively to do this in the conditions in which we have built up our present strength. I repeat the, record of I.C.I. is not peculiar. It is our privilege to have stood up to the responsibilities due to an organisation of our size and character. I have merely used our company as an example. What we have been able to do, most other enterprises have done according to their size and character. There is a biblical admonition very pertinent to private enterprise to-day. It is: Let your light so shine before men that they may know your good works. I recommend it to you all to-day and make it my justification for what I have said about ourselves."

Metallurgical Section

Published the first Saturday in the month

Metallurgical Section

February 5, 1944

The Alkali Metals in Alloys

A Survey of their Practical Application

by O. P. EINERL, Dr.Eng., M.Inst.M., and F. NEURATH, Ph.D.

THE technical production of the five alkali metals—lithium, sodium, potassium, rubidium, and caesium—on a commercial scale has made it possible to make use of them as alloying elements in technical alloys. The following survey aims at showing the trend of development and the application of alkali metals in the manufacture of non-ferrous, and even ferrous, alloys. The survey follows the same lines as the article on "The Alkaline Earth Metals and their Alloys", published recently in this journal[1].

The alkali metals are silvery-white, highly reactive metals, which tarnish rapidly in air. Their position in the periodic table of the elements shows that they are strongly electropositive and are the lightest among the twelve light metals, which include also the alkaline earth metals, beryllium, magnesium, aluminium, and also silicon, which, from the metallurgical point of view, may be regarded as a metal. The main physical constants of the

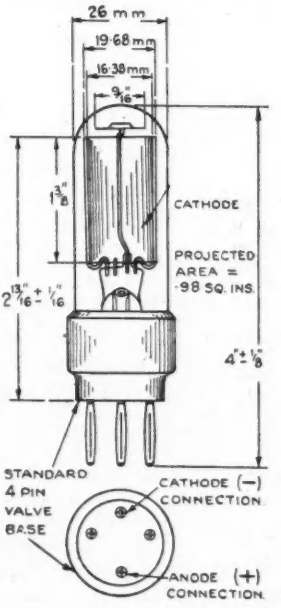
Element	Li	Na	K	Rb	Cs
Atomic Number	3	11	19	37	55
Atomic Weight	6.9	23	39	85.5	132
Density at 0°C	0.53	0.97	0.86	1.52	1.87
Melting Point in °C.	186°	97°	62°	38°	28°
Boiling Point in °C.	1609°	877°	751°	696°	670°

Fig. 1. Physical constants of alkali metals.

alkali metals are given in Fig. 1. Lithium, the lightest metal known, has a density of only half that of water. Melting and boiling points of the alkali metals are seen to fall rapidly with increasing atomic weight. Sodium and potassium occur abundantly in the earth's crust, but it was not long ago that lithium, rubidium and caesium were regarded as "minor rare elements." In fact, they are not rare; more lithium or rubidium occurs in the earth's crust than lead, and caesium is more abundant than silver.

Lithium appears to have a limited solubility in sodium, since it reduces the melting point of Na from 98° to 86°C., while sodium reduces the melting point of lithium from 186° to 179°C. Lithium is, however, immiscible with potassium, rubidium, and caesium, in both the solid and liquid state. Sodium forms compounds Na_2K and Na_2Cs with potassium and caesium, but no compound with rubidium. Potassium forms a complete series of solid solutions with rubidium and caesium, and the liquidus passes a minimum.

Rubidium and caesium and their alloys with one another are useful for eliminating the last traces of air from vacuum tubes and for obtaining high vacua for radio valves. These alloys are difficult to handle owing to their extreme reactivity in air. To introduce them into vacuum tubes, special devices have been developed by The British Thomson-Houston Co., Ltd.[2] Rubidium is more suitable than caesium for the manufacture of photo-electric cells, because a thinner layer can be deposited on the light-sensitive cathode.



[*By courtesy of B.T.H., Ltd.*

Fig. 2. Diagram of a photo-electric cell.

A photo-electric cell (Fig. 2) consists fundamentally of a sensitised surface—the cathode—

which emits electrons when light shines on to it, and this is sealed into an evacuated container with a second electrode—the anode—to which a positive potential is applied to attract these electrons. In the manufacture of photo-electric cells, caesium, rubidium, or alloys of the two are introduced in excess, but later removed entirely except for the molecular layer of alkali oxide that has formed on the silver or base-metal electrode. This surface possesses the highest sensitivity, especially to light from electric lamps, of any type of cathode at present in existence.

Alloys with Alkaline Earth Metals

Alloys of caesium with calcium, barium, or strontium can be produced by reduction of CsCl with metallic calcium, barium, or strontium in a vacuum ; the metal is collected in a glass tube and covered with a hydrocarbon oil containing no hydroxyl group that would react with caesium. The temperature for this process is between 50° and 80°C. These caesium alloys are more stable, and can be more easily handled, than metallic caesium ; the caesium is recoverable by vacuum distillation.

Cs-Ba-Al and Cs-Sr-Al alloys can also be produced by the same method, which is covered by a British patent[3] and can be used in the manufacture of photo-electric cells.

Lithium-calcium alloys are being produced in America on a technical scale by Maywood Chemical Works, New Jersey. Containing either 50 per cent. Ca and 50 per cent. Li, or 70 per cent. Ca and 30 per cent. Li, they are used for the deoxidising treatment of molten copper and bronzes, as hardeners for lead-base bearing metals (which will be discussed later on), and as additions to molten cast iron, carbon steel, and stainless steels, in order to improve the mechanical properties by graphite refinement in cast iron. Additions of lithium-calcium alloy to austenitic chrome-nickel steel result in better corrosion resistance, and a better surface after polishing.

Alloys with Beryllium and Magnesium

An alloy consisting of lithium and beryllium is claimed by an American patent[4] to be of extreme lightness, fair permanence, and considerable hardness. The beryllium protects the lithium from oxidation by moisture or heating and from further oxidation once a film has been produced on the surface of the alloy ; this film consists of a closely-adherent, finely-textured insoluble oxide. An alloy with 25 per cent. Li and 75 per cent. Be does not corrode faster than iron and its specific gravity is only 1.5. Alloys with up to 65 per cent. Li and the balance Be have been used for special purposes in aircraft parts in Germany, as this alloy is as light as water. Small quantities of Al or Zn may be added to increase the hardness and strength.

Magnesium alloys containing up to 1 per cent. Li have good casting properties and a great resistance to atmospheric corrosion. Peredelsky[5] mentions that maximum strength of 9 tons/sq. in. and up to 8 per cent. elongation are observed at 0.5 per cent. Li and 1.0—1.5 per cent. Li The Brinell hardness is about 45. The solubility of lithium in magnesium is 5.7 per cent. Li, and is independent of temperature. Higher percentages of lithium in magnesium lead to two series of solid solutions with rapidly falling liquidus and solidus, until the alloy with 12.5 per cent. Li and a composition of Mg_2Li is reached[6]. An alloy with 30 per cent. Li and 70 per cent. Mg, with a specific gravity of only 1.4, has found some application in aircraft construction, according to Sanderson[7]. The melting point of this ultra-light alloy is 480°C.

The phase diagram of the system sodium-magnesium, as compiled by Mathewson[8], indicates that the two metals are not mutually soluble in the solid state, and in the liquid state they are only soluble to the extent of 1 or 2 per cent. on either side. The same applies to potassium-magnesium ; the equilibrium diagram consists of two horizontal lines at the temperature of the melting points of the two metals. These metal combinations are therefore without practical importance.

Aluminium Alloys

The phase diagram of the system aluminium-lithium, as shown in Fig. 3, has been established by Czochralski and Rassow and confirmed by Assmann[9]. The solid solubility of lithium in aluminium at 600°C. is 3.5 per cent. Li, but at ordinary temperatures only 2.2 per cent. Li remains soluble. An intermetallic compound with 20 per cent. Li, and the composition AlLi, exists, which forms with the saturated solid solution of lithium in aluminium a eutectic with 7.3 per cent. Li. It is difficult to obtain higher Li contents, as lithium burns out continually from the liquid alloy, but it is possible to produce an alloy with 12 per cent. Li and 88 per cent. Al, which has the extraordinary Brinell hardness of 130 as cast. Lithium has therefore a greater hardening effect on aluminium than has magnesium. Binary aluminium-lithium alloys are not employed for industrial purposes, as those with higher lithium contents are pyrophoric in the same way as are alloys rich in cerium and ferrocerium. But small percentages of lithium have been added to aluminium alloys, and these alloys are heat-treatable[10].

Here belong the alloys "Scleron"[11], with 2-3 per cent. Cu, 12-13 per cent. Zn, 0.1 per cent. Li, balance Al ; "Telektal"[12], a rolling and forging alloy with 1.6 per cent. Si, 0.5 per cent. Fe, 0.1 per cent. Li, balance aluminium ; and "Aeron," a non-corrosive casting alloy with 4 per cent. Cu, 0.1 per cent. Li, balance aluminium. These alloys are being used for highly stressed parts in trucks and bed frames of tramcars and railway coaches[13]. The addition of silicon to lithium-containing aluminium alloys results in an improvement of the physical properties, which is attributed to the combined effects of Si and Li. This arises from the formation of the lithium silicide Li_2Si, whose solubility in aluminium decreases with falling temperature.

Heat treatment re-dissolves the silicide which, on quenching, remains in a supersaturated solution, as it is in an unstable state. Re-precipitation in a highly dispersed form occurs during age-hardening. This causes straining of the metal crystals, thus increasing the hardness considerably. The best age-hardening effects are obtained with lithium-containing aluminium alloys which contain, besides 4 per cent. Cu, up to 12 per cent. Zn, for which reason they are also termed "Zinc Duralumin alloys."

The influence of lithium in aluminium alloys is comparable with that of magnesium in Duralumin, but the hardening is not solely connected with the formation of Li_2Si. Like every aluminium alloy hardened by heat treatment, lithium-containing aluminium alloys should not be heated in service above 200°C. At normal temperatures the tensile strength is 25-35 tons/sq. in. with 20-10 per cent. elongation, figures that can compete with manganese bronzes and steels.

The solid solubility of sodium in aluminium is only 0.02 per cent. Na. The two metals are hardly soluble in the liquid state, and no practical application can therefore be expected. But the binary system Al-Na is of practical importance in connection with the ternary system Al-Si-Na, which forms the basis for the "modification" of the silicon-aluminium alloys with sodium or potassium or their alloys or salts or hydroxides. The method of "modifying" the coarse and brittle silicon-aluminium alloys into fine-grained alloys with excellent casting properties was discovered by Aladar Pacz[14]. By applying this "modification" it is possible to achieve a finer grain than that obtainable by shock-cooling the liquid silicon-aluminium alloy (without Na addition), while slow cooling without alkali addition would

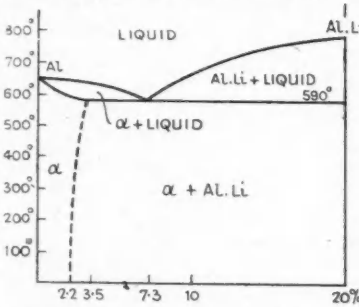


Fig. 3. The system aluminium-lithium.

result in a structure responsible for very low mechanical properties.

The ternary phase diagram Al-Si-Na is shown in Fig. 4. On the left-hand side of the line *a-b*, beginning in the aluminium corner, there is immiscibility in the liquid state. Only in the aluminium corner does there exist a very small field (shown black) of solid solubility with up to 2 per cent. Si and less than 0.02 per cent. Na (this side is exaggerated in Fig. 4). To the right of the line *a-b* there is complete miscibility of all the three metals in the liquid state. During cooling of the silicon-aluminium alloys, sodium,

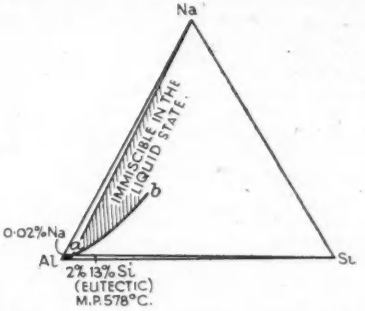


Fig. 4. Ternary phase diagram Al-Si-Na.

the "modifier," being only partly soluble even in the molten state, is thrown out, while aluminium and silicon begin to crystallise. The remaining liquid, now richer in Na, hinders the growth of the aluminium and silicon crystals, and this results in the production of a very fine "modified" structure in the alloy. The higher the Si content, the higher the corresponding point on the line *a-b* in Fig. 4. This means that larger quantities of Na can be applied, in proportion as the silicon content of the alloy increases. An alloy with 6 per cent. Si, balance aluminium, requires about 0.05 per cent. Na, while the alloys near the eutectic, with 13 per cent. Si, balance aluminium (*e.g.* Alpax, Silumin, L 33, Wilmil), require about 0.12 per cent. Na for full modification

Sodium burns out continuously from the liquid aluminium alloy, and it requires some experience to know exactly when to pour, as it is necessary to wait about 15 minutes before the sodium, which has been pushed under the surface and stirred in, can effect the modification throughout, without leaving "unmodified" islands.

Additions of sodium to copper-aluminium alloys have been tried and the results have been described by Claus and Goederitz[15].

As early as 1936 the influence of sodium (and calcium) on industrial aluminium was investigated by Grastchenko and Darowski[16], but the use of sodium for the refining of molten scrap aluminium has only been suggested by a recent U.S. patent[17], which claims that antimony, bismuth, lead, and tin can practically be removed from liquid aluminium alloys by stirring 0.1—1 per cent. Na into the metal, and removing the dross, while sodium enters the metal in small amounts.

Copper Alloys

An alloy with 2 per cent. lithium and 98 per cent. copper is being produced on a commercial

scale, and sold for the treatment of copper and its alloys, silver solder, and Monel. Since it has been possible to reduce the cost of lithium metal to about 5 per cent. of what it was during the last war, the U.S. price of commercial lithium-copper with 1.75—2.25 per cent. Li is now $1.00 per lb. (for ton lots), in this country about 7s. 6d. per lb. or a little more.

Lithium metal has long been applied commercially in the treatment of copper and copper alloys melted in electric furnaces, but the handling of the reactive lithium in ordinary foundry practice has proved too delicate. Since the lithium-copper alloy came on the market, progressive foundries have made the lithium treatment standard for their entire production of high-grade gunmetals, such as Admiralty gunmetal 88/10/2 and valve gunmetal B.S.S. 1021. The effect of a 2 per cent. lithium-copper alloy is explained by the fact that lithium reacts readily with hydrogen and hydrocarbons (forming LiH), with nitrogen (forming Li_3N) as well as with oxides and sulphides (forming Li_2O and Li_2S), to form insoluble non-metallic compounds, which have a low specific gravity and consequently flux out readily.

Foundries using lithium copper report that porosity in castings caused by gases dissolved in the molten metal has practically disappeared; and it is claimed that a pronounced grain refinement and increase in tensile strength, as well as in elongation, are constantly obtained. The application of 2 per cent. lithium-copper alloy requires no change in conventional practice, and additions are made in amounts ranging from 0.5 to 1 per cent. of the molten metal to be treated. Although the initial cost for the lithium treatment of molten gunmetal is still very heavy it is partly recovered, because of the superior quality of the castings and the minimising of waste after machining.

A lithium conductivity bronze, containing 98 per cent. Cu and up to 2 per cent. cadmium, tin, and lithium, is being marketed in America by Maywood Chemical Works, New Jersey, for high-strength conductors. A British patent[18] claims the improvement of a copper alloy (for bearing brasses directly adjacent to the journal in axle bearings of rail vehicles), consisting of 73 per cent. Cu, 20 per cent. Pb, 3 per cent. Ni, 1 per cent. Mn and 3 per cent. Sb, by the addition of sodium, whereas further additions of lithium and potassium increase the hardness of the alloy at the cost of corrodibility. An American patent[19] claims to enhance the hardness of high lead-containing copper-base alloys (with over 20 per cent. Pb), by adding sodium and calcium in amounts up to 0.2 per cent.

Considerable improvements are reported to result from the addition of lithium to silver solders. An addition of 0.12 per cent. Li to a silver solder with 65 per cent. Ag, 20 per cent. Cu, and 15 per cent. Zn improves the ease of flow; the resulting joints have more uniform and higher cross-breaking strength values. Lithium-containing silver solders give stronger joints than the usual low-melting silver solders B.S.S. 206 when jointing stainless steel, copper-nickel alloy, or Monel metal. A nickel-containing silver solder with 60 per cent. Ag, 20 per cent. Cu, 5 per cent. Ni, 15 per cent. Zn, and 0.1 per cent. Li is favourably reported on as a brazing alloy possessing high fluidity in combination with high strength.

Zinc Alloys

The system lithium-zinc has been established by Grube and Vosskuhler[20]. Zinc can retain 0.2 per cent. Li in solid solution. A compound Li_2Zn_3, with 6.6 per cent. Li, exists; this forms a eutectic with the solid solution of lithium in zinc. The eutectic alloy contains 0.6 per cent. Li, and has a melting point of 402°C. An alloy containing about 2 per cent. Li and 98 per cent. Zn is prepared on a commercial scale by adding small pieces of lithium to molten zinc under a protective layer of lithium carbonate and lithium chloride (the two latter substances being in equal proportions). This alloy is used for degassing zinc-containing bronzes and brasses. The American price for 2 per cent. lithium-zinc alloy in ton lots is 50 cents per lb.; no manufacturer of this alloy is known in Britain.

The constitution of the sytems sodium-zinc and potassium-zinc has been investigated by Zintl and Haucke[21]. A brittle alloy containing 2 per cent. Na and 98 per cent. Zn, manufactured on a commercial scale by the Grasselli Chemical Co., Cleveland, Ohio, is recommended as a deoxidiser.

Lead Alloys

The phase diagram of the system lithium-lead has been established by Czochralski and Rassow[22], and it is shown in Fig. 5. Solid

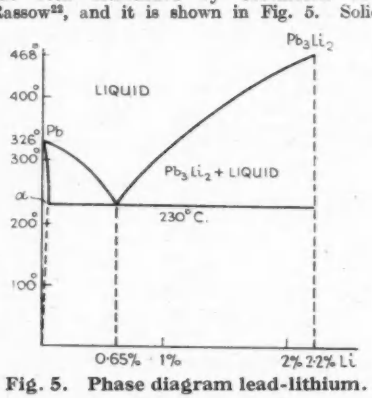


Fig. 5. Phase diagram lead-lithium.

solution of lithium in lead is below 0.1 per cent. Li, and there is a eutectic with 0.65 per cent. Li (melting point 230°C) between lithium and the compound Pb_3Li_2 with 2.2 per cent. Li. Lithium has a hardening effect on lead. An alloy with 0.1—0.2 per cent. Li, balance lead, has a Brinell hardnes of 14, against 10 for pure lead.

The alloy has good corrosion-resistance; X-ray examination shows that it has a beta-brass structure[23]. Alloys with 0.5 per cent. Li, 0.1 per cent. Ca, balance lead, do not corrode in air, show good castability, and have a Brinell hardness of 22.

The phase diagram of the system sodium-lead, as established by Mathewson[24], is shown in Fig. 6. The solid solubility of sodium in lead is 0.4 per cent. Na at room temperature, and increases

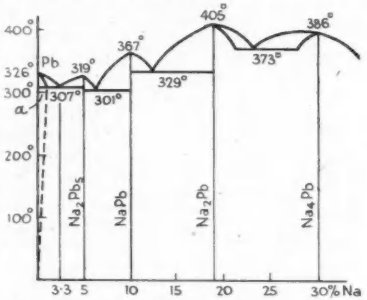


Fig. 6. Phase diagram lead-sodium.

to 0.6 per cent. at 100°C. Alloys with 0.6 per cent. Na age rapidly on heating to 100°C., and show the maximum hardening effect on lead. Alloys with 0.6—0.8 per cent. Na, balance lead, or with 0.06—0.12 per cent. Li, 0.2—0.4 per cent. Na, balance lead, start to solidfy at 300°—320°C.; they have a Brinell hardness of 14, and good corrosion-resistance, and can be used instead of tin-containing alloys in printing. They are satisfactory for filling electrotype.

"Tempered lead," or "Noheet," is a commercial lead-sodium bearing-alloy containing 1.3 per cent. Na, 0.12 per cent. Sb, 0.08 per cent. Sn, balance lead. An alloy with 2 per cent. Na and 98 per cent. Pb is also manufactured for dies by the Grasselli Chemical Co., Cleveland, Ohio. Sodium-containing lead alloys with higher Na contents have been recommended in place of metallic sodium for drying inflammable liquids, as this alloy is easier to handle than sodium. It can also be more easily brought to a fine state of subdivision.

Additions of magnesium to alkali-hardened lead alloys increase the hardness still further, and an alloy, containing 1.5 per cent. Na, up to 1 per cent. Mg, balance lead, is in use as a bearing metal. A lead-base alloy used for Diesel engine big-end bearings contains 1 per cent. Sn and 0.15 per cent. Li+K+Mg, balance lead.

The German lead-base bearing-metal "Bahnmetall," or "Bn-metal," with a Brinell hardness of 34, contains 0.6 per cent. Na, 0.04 per cent. Li, 0.6 per cent. Ca, balance lead. This metal, used for locomotive bearings, has the remarkable property of being able to retain its hardness at higher temperatures far better than most other bearing-metals; its melting point is 320°C. Three alkali metals are contained in the lead-base alloy "B" with 0.65 per cent. Na, 0.3 per cent. K, 0.4 per cent. Li, 0.75 per cent. Ca, balance lead. Several light and low-melting metals are contained in Satco Metal (S. & T. Metal Co., Illinois[25]), which consists of 0.04 per cent. Li, 0.04 per cent. K, 0.07 per cent. Mg, 0.05 per cent. Al, 0.25 per cent. Hg, besides 0.5 per cent. Ca and 1 per cent. Sn, balance lead.

Other Alloys

Before ending this survey of modern extensions of the field of technical alloys by additions of alkali metals, the photo-electric alloys of caesium with antimony, with bismuth, and with gold should be mentioned. The electrical resistance of Sb-Cs alloys increases sharply with increasing caesium content, an alloy corresponding to the compound $SbCs_3$ showing the highest photo-electric quantum yield. Similar effects are obtained with bismuth-caesium alloys. Gold forms alkali compounds which are photo-electrically sensitive, the absorption of visible light decreasing from AuNa to $AuCs$[26].

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Preheating Steels

Accurate Temperature Measurement

THE accurate preheating of high tensile steels, non-ferrous metals, and cast iron has been established as being essential to the production of sound welded constructions. The difficulty in the past has been in obtaining a suitable method of reading pre-heat temperature under workshop conditions; Tempilstiks have been found to be both accurate (± 1 per cent.) and easy to use; they are now readily available for the following temperatures: 125°, 150°, 175°, 200°, 225°, 250°, 275°, 300°, 350°, 400°, 450°, 500°, 550°, 600°, 650°, and 700°F. Tempilstiks are chemical mixtures with fixed melting points, and are used in two ways.

(1) A mark about ¼ in. long is made on the job to be welded in much the same way as a chalk mark would be made. Heat is then applied, and when the mark melts and virtually disappears, the temperature stated on the particular Tempilstik used has been reached. This method should be used only when the pre-heating flame does not play directly on the locality where the mark has been made.

(2) Where the entire surface of the work may come into contact with the pre-heating flame, the temperature is ascertained by periodically removing the flame and marking the job as before. The correct temperature has been reached when the mark melts as soon as it is made.

The pre-heating chart shows ranges of pre-heat temperatures recommended for different metals, and can be had on application to the Director for Sundry Materials, Ministry of Supply, 8-10 Old Jewry, London, E.C.2.

Silicon Bronze Alloys

Points for Casting Practice

IN the foundry, silicon bronzes often can be successfully used as a replacement for high-tin bronzes. They are capable of giving close-grained, homogeneous castings of high strength, toughness, good resistance to corrosion, and suitability for pressure work. When molten they are very fluid, producing sharp and well-defined castings from sand moulds. Silicon bronzes may be melted without difficulty in pit fires or tilting furnaces of the coke-, oil-, or gas-fired types. Melting should be carried out as quickly as possible.

The limits of composition have been given as: Si, 1.50 to 5.00 per cent.; Mn, 1.50 per cent. max.; Zn, 5.00 per cent. max.; Fe, 2.50 per cent. max. Other elements, 0.50 per cent. max.; Cu, remainder. The composition of one alloy in fairly wide use now is: Si, 3.0 to 4.0 per cent.; Fe, 1.4 to 2.0 per cent.; Mn, 1.0 per cent. max.; P, 0.1 per cent. max.; Zn, 1.5 to 2.5 per cent.; Cu, remainder.

Silicon bronzes possess the following approximate characteristics: density (cast), 8.4 grams per c.c.; weight per cubic inch, 0.303 lb.; shrinkage, 5/32 to 3/16 in. per ft. In practice the mechanical strength of silicon bronzes ranks well above that obtained with the gunmetals and similar alloys in which tin is an important constituent. Standard test-pieces cast in green sand give the following average properties: ultimate tensile stress, tons/sq. in., 22; elongation per cent. on 2 inches, 20; Brinell hardness (10 mm. ball, 500 kg. load), 90.

Characteristic of all silicon bronzes is their short freezing range, approximately 50°C., and shrinkage therefore takes place at a greater speed than in gunmetals. This necessitates special attention to the feed requirements, heads and runner of generous size being required. Various moulding methods may be employed for casting silicon bronzes, provided that the above points receive due attention. Where the design of the castings is such that adequate feeding metal cannot be introduced, chilling may be resorted to with advantage.

As regards moulding and core-making sands, silicon bronzes cast well with the usual types of sand used for other non-ferrous alloys such as gunmetal, phosphor bronze and manganese bronze, and ordinary facings, as lithite and plumbago, give good results when used with green sand or dry sand moulds. Care should be taken, however, to ensure ample permeability, as impermeability produces skin porosity. Silicon bronze castings are clean when removed from either green or dry sand moulds, provided that an unduly high casting temperature is avoided. Castings removed from the moulds while red hot will not scale unduly.

STEELWORKS COMBINE

Some three years ago we reported the amalgamation of the steelworks-equipment interests of Joseph Adamson & Co., Ltd., of Hyde, Cheshire, and the Alliance Machine Co., of Alliance, Ohio, U.S.A., the new company thus formed being the Adamson-Alliance Co., Ltd., of 165 Fenchurch Street, London, E.C.3. A further development has now taken place, in the formation of Adamson-Horsehay Associated, Ltd., with head office at the same London address. This last company combines the interests of Joseph Adamson & Co., Ltd., and the Horsehay Co., Ltd., of Wellington, Salop, in the manufacture of mechanically-operated steelwork structures of all types. The new grouping represents a strong association at the service of the steel industry, extending now to cover the erection of steelwork and general mechanical-handling equipment of every description.

Metallurgical Specifications

Spot Welding for Mild Steel

B.S. 1140, issued by the British Standards Institution, relates to the application of spot welding to the fabrication of mild steel assemblies comprising two or more thicknesses of metal. Applications have been classified under two broad headings, determined by the relation between the mechanical strength of the structure and individual welds; the essential features of the types of welding machine for these two classifications are laid down. The specification defines the chemical composition for the parent metal and includes recommendations as to suitable steels. Mechanical tests are not included.

Secondary Zinc Alloys

War emergency specification No. 1141 has just been issued by the British Standards Institution in order to make use of remelted redundant zinc alloy castings conforming to B.S. 1004. A large tolerance on copper has been allowed and the limits for other impurities, *e.g.*, lead and tin, have been raised above the low limits of B.S. 1004. The initial physical properties of the alloy will vary between those of Alloy A and Alloy B, but it is urged that the application should be confined to uses where maintenance of physical properties and dimensional stability are not of primary consequence.

Copies of both the above are obtainable from the Institution, 28 Victoria Street, London, S.W.1, B.S. 1140, 2s. each, B.S. 1141, 1s. each.

Nickel Schedule

An additional section covering nickel and nickel alloys is included in B.S./STA 7 (Services Schedule of Non-Ferrous Metals). The new section includes tables giving the mechanical properties, and tables giving the relevant uses and general notes, for all metals covered. The tables have been issued in loose-leaf form so that they can be inserted in cover of B.S./STA 7 in their appropriate place. Copies of the Nickel Schedule which for convenience in ordering has been given the reference number P.D. 191 are obtainable from the B.S.I., price 6d. (3d. each for 12 or more).

Aluminium Alloy Spot Welds

B.S. 1138 deals with test pieces for shear testing of spot welds of aluminium base alloys and is intended to standardise production-control procedure and to provide reliable indications of the quality of welds. The standard describes two test pieces, one of which is for material up to 18 S.W.G. (0.048 in.) and the other for thicknesses exceeding 18 S.W.G. In addition, there are clauses dealing with the welding procedure, the testing procedure, and the various test results which should be recorded. Copies from the B.S.I., 1s. each, post free.

Canadian Aluminium

Metal Controller's Forecast

IN a recent address to the Dominion Parliamentary Committee on aluminium, Mr. George C. Bateman, Canadian Metal Controller, stated that Canada had reached a point at which she must give very serious thought to what was going to happen to her mining and metal industries after the war.

"With the completion of the war," he said, "there is no programme that will be cut as quickly as aircraft production. So that at the end of the war we shall have a tremendous aluminium capacity in Canada, about twelve times that of pre-war capacity, which not only will have to try to find new outlets in competition with other materials, but also will have to face the competition of great tonnages of scrap. In about five days, at present rate of production, we could fill all the probable annual requirements for post-war aircraft production."

Post-War Competition

Mr. Bateman referred to the various materials with which aluminium would have to compete in the post-war world. He emphasised that in each case the determining factor was not the cost per pound of the primary metal or material but the ultimate cost of the finished article. He said that the raw material was a relatively minor part of the cost of the finished product, so that what had to be considered was the ultimate cost; that included the cost of aluminium, the cost of fabricating, and the cost of production in assembling the fabricated parts. "This is a matter to which I have given a good deal of thought," he continued, "and regarding which I am very concerned, because my business, my life, has been spent with the mining industry, and I see a lot of trouble ahead of it."

"While these problems will apply with force to all the primary non-ferrous metals and minerals (aluminium, copper, lead, zinc, and nickel), they probably will apply to a much greater extent to aluminium because of the fact that aluminium capacity has been expanded to a much greater extent than that of any other metal. And that expansion has been almost entirely to meet the needs of the aircraft programme. I am a firm believer that we are entering the age of light alloys, but under to-day's conditions of technological advances you have to revise your conception of what constitutes a light alloy. I expect aluminium to continue as one of our great Canadian industries. I expect to see it expand in post-war markets, and I also believe that any great expansion above the pre-war markets is going to represent a very difficult time or condition and can only be attained by the expenditure of a great deal of money carried on over a period of a good many years."

Marketing of Tin

Plans for the Post-War Period

THE major problem facing the tin industry is to build up an organisation which will create a market sufficiently wide to maintain producers at a reasonable level of activity. This requires a consumption approaching 250,000 tons of tin annually. In financial terms, the pre-war market for, say, £30,000,000 per annum has to be re-established, and over and above this an additional market for upwards of £20,000,000 worth of new tin annually has to be discovered and developed: a selling task of considerable magnitude. This is the keynote of a recently published report describing a plan worked out by Mr. John Ireland, director of the Tin Research Institute. It is shown that sales depend on the satisfaction of the ultimate consumer and that where better service can be given, expanded consumption follows.

The proposed scheme will harness to the problem of increasing the usefulness of tin, the full resources of a modern scientific organisation comprising a nucleus of scientists whose fundamental work will be carried to the stage of practical application by research teams working on a semi-industrial scale under the guidance of committees representing the principal tin-consuming industries.

Information Bureaux

An important feature is the establishment of Information Bureaux in all the important tin-consuming centres throughout the world. These bureaux will be staffed by practical experts ready to go into factories and put any tin-consuming process into first-class working order in the light of the most recent scientific knowledge. The experience gained in giving this type of service in Britain, and on a smaller scale in the U.S.A., has proved that there is a widespread need for it even in these areas where manufacturing technique is highly developed; and in other consuming countries there is even greater scope.

The report explains the proposed post-war organisation in detail, and also indicates some promising new uses arising out of the Institute's researches, giving quantitative estimates of the increased sales that may be expected as the result of the new organisation's activities at the end of a ten-year period. The budget recommended to finance these activities—including research, development, world-wide technical service, and publicity—is £300,000 a year. This sum, though much larger than that with which the present organisation has been working, is much less than is devoted to other metals, and is only about one per cent. of the gross value of the tin sold annually before the war.

Parliamentary Topics

Tungsten and the Blockade

IN the House of Commons last week Mr. George Strauss asked the Parliamentary Secretary to the Ministry of Economic Warfare when the agreements were made between this country and the Portuguese Government which permit the present Portuguese exports of wolfram to Germany, and what is their duration.

The Parliamentary Secretary to the Ministry of Economic Warfare (Mr. Dingle Foot) said he could not accept the implication that they had been parties to any agreement which permitted the export of wolfram to Germany. The last agreement between H.M. Government and the Portuguese Government fixing British purchases of wolfram was arrived at in September, 1943. The present allocation of wolfram would remain in force until fresh arrangements were made.

Mr. Strauss: Is the hon. gentleman aware that the House was told by the Foreign Secretary that the present exports of wolfram from Portugal to this country and Germany were arrived at by agreement between this country and the Portuguese Government; and is it not rather surprising that such an agreement could have been made as late as September last year?

Mr. Foot: No, Sir. My hon. friend clearly misunderstood what the Foreign Secretary said. The only agreement that could or would be arrived at between H.M. Government and the Portuguese Government is an agreement governing our own purchases of wolfram.

Spanish Exports

Mr. Molson asked the Parliamentary Secretary to the Ministry of Economic Warfare if he had any information as to how much tungsten was being exported from Spain to Germany; and what steps he was taking to induce the Spanish Government to discontinue this trade.

Mr. Foot: My department estimates that exports of wolfram from Spain to Germany during the past year have averaged approximately 100 tons a month. We have ourselves made considerable purchases, but it would not be in the public interest to announce what other steps H.M. Government are taking, or contemplate taking in the future.

Mr. Molson: Has the Ministry of Economic Warfare considered the desirability of restricting the navicerts for the importation of oil into Spain unless a reduction takes place in the exports from Spain to Germany of valuable minerals?

Mr. Shinwell: Can we be assured that the Government are doing something?

Mr. Foot: Yes, Sir.

Hydrofluoric Acid Plant

Storage and Piping for the Anhydrous Material

IN work on the production of anhydrous hydrofluoric acid conducted by the author's company in 1931, laboratory and pilot-plant tests were made to determine roughly what constructional materials were satisfactory. While these tests were helpful in the development of an entirely new process, they did not tell the complete story. It was only after the process was actually in full-scale operation that real progress was made. It was found that because of its low corrosion rate, mild carbon steel was excellent for handling anhydrous hydrofluoric acid and was the logical material for storage tanks, pipes, fittings, valves, and pumps. This conclusion has been sustained by experience during the past twelve years and it may be positively stated that steel tanks for storing HF have been in service for ten years and are in good condition to-day.

The shipping container problem has been solved by the use of steel. Apparently, a protective coating forms on the surface of the steel, inhibiting further corrosion. This becomes a problem on valves, in that it will cause them to freeze, unless they are operated at fairly frequent intervals, probably because the film cements moving parts together. By opening and closing valves at least twice each shift this operating difficulty may be avoided. Obviously, double-valving is required. Some steels are more resistant than others to anhydrous hydrofluoric acid. A thoroughly deoxidised, dead-melted, or killed steel in which the non-metallic inclusions are absolutely at a minimum is the ideal steel. Bessemer steel is not desirable, owing to lack of precise control.

Steel or Monel

Experience with Monel has been satisfactory and it appears the best of all commercially available non-ferrous metals for HF. However, with the present restrictions on the use of nickel alloys, steel is preferable wherever possible. For the fabrication of laboratory equipment for handling HF, such as sample bottles, valve parts, especially the valve stems, and for parts in contact with weaker acid, Monel metal is ideal and should be used.

Copper has been found satisfactory in various parts of the process, and under proper conditions is a close second to Monel. It is, however, attacked in the presence of sulphur dioxide and oxygen and, where these are present in the anhydrous acid, copper is unsatisfactory. We recently examined a copper coil, put into operation in 1931 for two years and recently returned to service, and found it still in good working order. copper tubing is excellent, especially where flexible connections are needed. Silver and platinum may also be employed where the construction justifies. Platinum is probably the most resistant of all metals to HF, and silver has an excellent resistance in the absence of sulphides or appreciable quantities of sulphuric acid.

Readers are cautioned to interpret these recommendations as applying to anhydrous hydrofluoric acid only, since steel is not satisfactory for HF below 60 per cent. Monel, copper, silver and platinum are resistant to the weaker acids except under the specific adverse conditions already noted. Platinum and silver are particularly useful for small parts or for special members such as frangible discs.

Unsuitable Materials

Among the unsatisfactory materials of construction, probably the most readily attacked are those containing silica, such as glass, porcelain, enamelware, asbestos, and certain silica cast irons. While lead is serviceable for acids below 65 per cent., under normal conditions it is unsatisfactory for strong acids, especially anhydrous HF. Cast iron is more resistant to HF than lead but, probably because of silica inclusions, it is not a generally satisfactory material. Cast-iron fittings will last only a comparatively short time before replacement. Among other materials found unsuitable for anhydrous HF are wood, which chars instantly; rubber, which polymerises and hardens; and most plastics. We have hopes, however, of a non-flexible plastic which is now being studied as a desirable material.

Steel tanks are the logical storage vessels for HF and should be of welded construction. A proper system of outlets must be provided. Insulated storage tanks should not be loaded to more than 90 per cent. of their water capacity; non-insulated tanks to 85 per cent. Where practicable, scale-mounted tanks are preferable to level indicators because they occasion the least error and trouble.

Extra-heavy seamless steel pipe and forged or cast-steel fittings are best for handling HF. Welding makes the ideal joint, provided that the weld is homogeneous and free of slag and oxides. Welded fittings should be used wherever possible. If threaded joints are used on small pipe, the threads should be carefully cut, pulled up tight, and seal-welded. Some designers do

* Abstract of part of an address by C. M. Fehr, Pennsylvania Salt Mfg. Co., Philadelphia, to the Western Petroleum Refiners Assoc., July 9, 1943. From *Chem. & Met. Eng.*, 1943, *50*, 11, 129.

not seal-weld pipe under 0.5 in. size, and report that threaded joints are satisfactory. We caution against cast-iron fittings. For connecting pipe larger than 2 in., ring flanges with soft iron or copper gaskets are satisfactory. Asbestos gaskets impregnated with Neoprene or Vistanex have been successful, especially on small lines. Heavy copper tubing is satisfactory for flexible connections to scale-mounted tanks.

Needle, globe, and gate valves have been used successfully. Whenever possible, we prefer a needle or globe valve, on account of its stout construction. Steel is an excellent construction material and valves may be either machined from bar stock or forged.

Personal Notes

MR. W. J. PIGGOTT, secretary and commercial manager of B. Laporte, Ltd., has been elected a director of the company.

PROFESSOR H. W. FLOREY, the authority on penicillin, has arrived in Moscow, where he will be informing biochemists and medical scientists about recent work done on penicillin in Britain and the U.S.A.

MR. WILLIAM MATHIESON, who has been managing director of Wilsons and Mathiesons, Ltd., ironfounders, of Armley, for ten years, has been elected president of the Leeds Chamber of Commerce, in succession to Mr. E. B. Laycock

The Council of The Institute of Metals has elected four Honorary Members of the Institute, one each from the four principal Allied Nations: China, MADAME CHIANG KAI-SHEK; Great Britain, SIR LAWRENCE BRAGG, F.R.S.; U.S.A., DR. IRVING LANGMUIR; U.S.S.R., PROFESSOR P. KAPITZA, F.R.S.

PROFESSOR P. M. S. BLACKETT has succeeded Sir Robert Watson-Watt as president of the Association of Scientific Workers. Aged 46, he holds the post of Langworthy Professor of Physics at Manchester University, but at present is engaged on research for the Admiralty. In the last war he served in the Navy, and it was in fact not until he was discharged from that Service in 1919 that he began his scientific career. Under Rutherford's direction he carried out work at the Cavendish Laboratory which led to the discovery of the positron, or positively-charged electron. His researches into the phenomena associated with cosmic radiation he continued in London when he became professor at Birkbeck College, and considerable public interest was taken in his investigations of the depth of penetration of cosmic rays, which was done in a laboratory set up on a disused platform of Holborn underground station. In 1940 he was awarded the Royal Medal of the Royal Society.

MR. ROBERT H. S. ROBERTSON, M.A., F.G.S., son of Sir Robert Robertson (formerly Government Chemist), has been appointed Research and Scientific Adviser to the Scottish Co-operative Wholesale Society in Glasgow. He was previously assistant manager of the Fullers' Earth Union, Ltd., and was last year with Cefoil, Ltd., manufacturers of seaweed alginates.

Obituary

MR. CHRISTOPHER DALLEY, who died on January 28 at Sutton, Surrey, at the age of 60, was president of the Institute of Petroleum. He was joint managing director of British Controlled Oilfields, Ltd., and of the Trinidad Petroleum Development Co., Ltd.

MR. CHARLES BURRARD KINGSTON, president of the Institution of Mining and Metallurgy in 1938-39, died recently at Forest Row, Sussex, aged 76. He was an alumnus of McGill University, which conferred on him the honorary degree of LL.D. in 1930. He had held appointments in Canada, the U.S.A., and Australia before going to South Africa as consulting engineer to the Anglo-American Corporation. From 1918 to the present time he played a leading part in the development of the Rhodesian copper mines.

A recent number of *Chemisch Weekblad* reports the death of DR. J. J. WIJS, the famous Dutch chemist, at the age of 78. His method of determining the iodine value of oils and fats, giving what is called the "Wijs number," is still widely used It depends on the action of a solution of iodine monochloride in acetic acid on the fat, and gives a measure of the proportion of unsaturated fatty acids present, since one atom of iodine absorbed indicates the presence of one double bond. The technique was originally described in the *Analyst* in 1900.

DR. FREDERICK DANIEL CHATTAWAY, M.A. (Oxon), D.Sc. (Lond.), F.R.S., F.I.C., died at Torquay on January 26, aged 83. One of the original university students at Aberystwyth, he continued his studies in chemistry at Christ Church, Oxford, and at Munich. Returning to England, he was appointed lecturer at St. Bartholomew's Hospital, London, and in 1910 went to Oxford to assist G. B. Cronshaw in the laboratory of Queen's College, of which he became a Fellow in 1919. His work covered a wide field in organic chemistry, and he was particularly concerned with the elucidation of organic chemical reactions, contributing a number of articles to the *Journal of the Chemical Society*. He served on the councils of the University College of Wales and of Birmingham University. He was vice-president of the Royal Institute of Chemistry in 1903-1905 and 1930-33, and for a time was chairman of the Institute's publications committee.

General News—From Week to Week

To accommodate a plastics factory, De La Rue Plastics, Ltd., have bought a site in the Tynemouth area.

The savings group of Joseph Lucas, Ltd., and associated companies, has raised £1,000,000 in four years; 79 per cent. of the employees are members.

The revival of the British Industries Fair immediately after the war was advocated last week by Mr. Gilbert Gledhill, M.P. for Halifax.

A benzol-recovery plant was officially opened last week in a Lancashire gasworks. A feature of the plant is that its control is entirely automatic.

The municipal engineers of Liverpool are to be asked to submit a report to the council on the possibilities of supplying steam heating from central power stations through distributing networks and sub-stations.

Serious pollution of the Welland, the Lincolnshire river which flows into the Wash, has led to the formation of an anti-pollution committee. The condition of the river Witham has also deteriorated, it is alleged.

A film showing the new British infantry anti-tank projector, the "P.I.A.T.," in action, was shown on Tuesday at the London headquarters of I.C.I., the firm to which its development was entrusted.

Leamington Corporation sewage purification works at Heathcote have been trying out the preparation of compost from wheat straw and sewage sludge. The results have been encouraging.

Two summer courses for Safety Officers are being arranged by ROSPA, and a third is mooted, while accommodation for an Easter course is also being sought. Full details of the plans of these will be issued as soon as the information is available.

The Newcastle Chemical Industry celebrates its silver jubilee this year. The 25th annual meeting is being held on February 24, when Mr. R. Williams will give a talk on the mechanisation of coal mines, to be followed by a film illustrating the machinery used.

The Association of Scientific Workers is now able to issue permits for alarm clocks for scientific workers, members and non-members, who have to wake up between 12 o'clock midnight and 5 a.m. in order to get to work.

An experimental house built largely of the by-products of whisky distillation was mentioned by Lord Dudley at the speech-day of the Dudley and Staffordshire Technical College. Another by-product which could be used in house building was blast-furnace slag, he added.

H.M. Stationery Office has issued Factory Form 1000, which gives an abstract of the Factories (Luminising) (Health and Safety Provisions) Order, 1942, as amended by an Order of 1943. The forms cost 2d. each (by post 3d.).

A series of "health weeks" is to be held in factories all over the country. The first, in the Midlands, was opened by Sir Stafford Cripps last week. The object is to show workers how, by simple methods, they can safeguard themselves against accident and illness.

A technical monograph entitled "Arkon Instruments in Gas Works" has just been published by Walker, Crosweller & Co., Ltd., Whaddon Works, Cheltenham. A copy will be sent on request (enclosing 1d. stamp) either to that address or to the London office, at 6 Gordon Square, W.C.1.

A bone-processing works in the Midlands, extracting from household salvaged meat-bones materials for making explosives, glue, animal feeding-stuff and fertilisers, received the skeletons of two elephants, a lion, a kangaroo, and an ostrich. "It is uneconomic, however, to deal with bones of this type," was the comment of a Ministry of Supply official.

Three new industrial safety posters are being prepared by the Royal Society for the Prevention of Accidents. One deals with the carbon monoxide hazard; the two others, described as "What's Wrong?" posters, are pictures of a machine shop and a factory yard, in both of which a large number of "sins against safety" are depicted.

Pure styrene was so vital to the making of the insulators needed for early radiolocation work in Britain that it was prepared at very great cost from phenyl ethyl alcohol. This fact was revealed by Dr. John J. Grebe, of the American Dow Chemical Co., in his medallist's address to the Society of Chemical Industry.

The council of the British Electrical and Allied Trades Association has decided to buy a site at Leatherhead, Surrey, adjacent to that secured by the B.C.U.R.A., and to co-operate with several other associations who have found that they will require better research facilities to meet the needs of their industries.

Half the production hours involved and a quarter of the material used in the production of asbestos insulating jackets for aircraft fuel tanks have been saved in a British factory, as the result of a suggestion of a woman supervisor in the sewing-machine shop, according to a statement by the Parliamentary Secretary to the Ministry of Production.

Six lads stated to be members of a Scottish nationalist organisation, were sentenced at Glasgow Sheriff Court, on Monday, in connection with the explosion that wrecked the boardroom of I.C.I., Glasgow, on January 7. All admitted throwing six hand grenades into the premises. Three of the defendants were sent to prison for nine months, and the other three for eight months.

The Iron and Steel Institute has issued a booklet (price 2s. 6d.) on "The Training of Metallurgists." Though looking with optimism to the future of British metallurgy, the pamphlet gives warning of the prospective shortage of traincd metallurgists, and the importance of a properly regulated scheme of education for metallurgical students is emphasised.

A cheque for £4500 was presented to the hon. treasurer of the Joint Committee for Soviet Aid by Sir Robert Watson-Watt at a film show held in London last Sunday. The money represented the total so far received towards the Stalingrad Hospital Laboratory Fund. The original target has already been exceeded by £1500, but it has been decided to leave the fund open until March.

Disabled workers do as well in industry as able-bodied workers, was the contention of Major Manningham-Buller, speaking in the Commons debate last week. He quoted statistics that had been collected from over 100 American firms. These showed that 23.8 per cent. of the disabled workers produce more than the average for able-bodied workers; the average output was reached by another 65.7 per cent., while only 10.5 per cent. produced less than that quota.

Foreign News

The United States are suspending oil shipments from the Caribbean area to Spain during February.

A synthetic rubber conveyor belt has been marketed by the Goodyear Tyre and Rubber Co., Akron, Ohio. The belt is said to be particularly suitable for mining operations.

During the R.A.F. raid on Magdeburg on January 21, the I.G. Farben chemical factory, a sugar refinery and a synthetic fuel plant were hit, state reports from Berne.

Sugar is being extracted from the sap of birch trees in Russia. The sap, of which a single tree yields about 25 gallons a day, is processed by a method elaborated at the Sverdlovsk scientific research station.

A substitute for cork has been perfected after four years' research at the Georgia Experiment Station. The raw material is waste peanut shells, of which millions of tons are available.

The American drug manufacturers, Norwich Pharmacal Co., has established two fellowships at Syracuse University, the total grant being $2500 for work on antibacterial agents.

Widespread diversion of naphtha in the United States for "stretching" petrol rations is estimated to take 65,000 gallons a day, with a resultant shortage in industrial solvents. It is expected that sales for use in petrol for civilian cars will be prohibited.

Forthcoming Events

Papers on industrial health in the rubber industry by Major F. Monk, M.C., and Miss G. Martin Harvey, will be read to the meeting of the **Institution of the Rubber Industry,** to be held at Caxton Hall on **February 7,** at 6.30 p.m.

"Advances in Photographic Chemistry" is the subject of the paper which Dr. H. Baines, F.I.C., is presenting to the **Society of Chemical Industry,** London section, at its meeting on **February 7,** at 2.30 p.m., in the Chemical Society's rooms, Piccadilly.

At the joint meeting of the **Society of Chemical Industry,** Chemical Engineering Group, and the **Institution of Chemical Engineers,** to be held at 2.30 p.m. on **February 8,** at the Geological Society, Burlington House, Piccadilly, Mr. J. Arthur Reavell will lecture on "Infra-Red Radiation and its Relation to Distillation and Evaporation Problems."

Mr. F. A. Robinson will present a paper on "The Vitamin B_2 Complex," at the meeting of the Nutrition Panel of the **Society of Chemical Industry,** at 2.30 p.m., on **February 9,** in the rooms of the Chemical Society, Burlington House, Piccadilly.

The sixth set of Fuel Economy Lectures arranged by the **Association of British Chemical Manufacturers** and the **British Chemical Plant Manufacturers' Association,** are being delivered in London, at 2.30 p.m., on **February 9,** in the lecture theatre of the Royal Society of Tropical Medicine, 26 Portland Place, W.1. Mr. L. S. Yoxall (Foxboro-Yoxall, Ltd.), is speaking on "Automatic Heat Control," and Mr. J. W. Grose (Kestner Evaporator & Engineering Co., Ltd.), on "Evaporators." Non-members should notify Mr. A. J. Holden, A.B.C.M., 166 Piccadilly, W.1, of their intention to attend.

Mr. M. T. B. Wilson is giving a paper on "Water Purification" at the meeting of the **Royal Institute of Chemistry** (Manchester section), arranged to take place on **February 10,** in the Engineers' Club.

Dr. A. J. Ewins, F.R.S., will deliver the Harrison Memorial Lecture to the **Pharmaceutical Society,** 17 Bloomsbury Square, W.C.1, on **February 10,** at 7 p.m. His subject will be "The Progress and Problems of Chemotherapy."

Professor Ingle Finch, F.R.S., is to lecture on "Wear of Surfaces and Lubrication," at the **Royal Institution,** London, on **February 11,** at 5 p.m.

The **Chemical Society**, S. Yorks. section, meets on **February 11**, at 5.30 p.m., in the University, Sheffield, when Mr. S. Ellingworth will speak on "The Synthesis of Chemotherapeutic Agents."

The **Society of Chemical Industry, Chemical Society,** and **Royal Institute of Chemistry,** are holding a joint meeting on **February 11,** in the medical lecture theatre of Edinburgh University. The meeting starts at 7.30 p.m., when Professor G. M. Bennett will lecture on "Molecular Regimentation in Solids and Liquids."

The next meeting of the **International Society of Leather Trades' Chemists,** Manchester group, will be held at the Engineers' Club, Albert Square, Manchester, on **February 12.** The programme includes two films on the manufacture of footwear, and a paper by Dr. H. M. Davies, of the Leather Manufacturers' Research Association, on "The Use of Statistical Methods in Leather Research."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

HEMINGWAY & CO., LTD. (formerly HEMINGWAY'S CHEMICAL PROCESSES CO., LTD.), London, E. (M., 5/2/44).—January 3 charge, to Merchants & General Finance Corporation, Ltd. and Metallo-Chemical Refining Co., Ltd., securing any moneys which Merchants & General Finance Corporation, Ltd., advance to the company, or which it and/or Metallo-Chemical Refining Co. may be called upon to pay under any guarantees given by them on behalf of the company; general charge (other than fixed assets, etc.) (ranking in priority to a debenture already issued). *£15,000. July 7, 1943.

METALLO-CHEMICAL REFINING CO., LTD., London, E.C. (M., 5/2/44).—January 3, charge to Merchants and General Finance Corporation, Ltd., securing any sums which may at any time become due and owing by Hemingway & Co., Ltd., to the charges and all sums which the chargees may be called upon to pay under any guarantee or guarantees given by them on behalf of Hemingway & Co., Ltd.; charged on a debenture dated May 31, 1943, issued by Hemingway & Co., Ltd., in favour of company. *Nil. July 9, 1942.

Chemical and Allied Stocks and Shares

A FIRMER trend has been in evidence in Stock Exchange markets, where sentiment was aided by the rise in British Funds that followed the decision to repay the 5 per cent. Conversion Loan. Although business in industrial shares was on a moderate scale, they were well maintained in price. Imperial Chemical, whose dividend is confidently expected in the market to be kept at 8 per cent., were 38s. 1½d., or within 1½d. of the level current a week ago. Pending the dividend announcement, Borax Consolidated have improved from 37s. 6d. to 38s. 3d. British Aluminium at 47s. 6d. held most of their recent improvement, while British Oxygen were maintained at 80s. 6d. Following an earlier decline, Triplex Glass rallied to 37s. 10½d., and at 78s. 3d. Turner & Newall regained an earlier small reaction. The units of the Distillers Co. have remained at 88s. 6d. at the time of writing, while United Molasses 6s. 8d. units were quite well maintained at 32s. 4½d. Burt Boulton changed hands up to 22s. 6d., and British Drug Houses were 23s. Cellon 5s. ordinary were also 23s. Elsewhere, Lewis Berger continued to attract attention and showed dealings up to 98s. 6d., sentiment being aided by future possibilities attaching to the company's plastics interests. International Paint have moved up to 115s. 6d. awaiting the forthcoming dividend announcement.

In other directions, Wall Paper Manufacturers deferred units eased from 38s. 6d. to 37s. 9d. A reaction from 64s. 6d. to 64s. was shown in Associated Cement, but elsewhere, British Plaster Board further strengthened from 29s. to 29s. 6d. Gas Light & Coke ordinary rallied from 20s. 3d. to 20s. 9d. in response to market estimates of a dividend of at least 4 per cent. for the year. Business in B. Laporte ranged up to 77s. 6d., while W. J. Bush were again quoted at 60s. United Glass Bottle were also 60s. Fisons were 47s. 6d., awaiting the dividend. De La Rue eased to 157s. 6d. British Industrial Plastics 2s. ordinary were 6s. 10½d., Erinoid 5s. shares 10s. 9d., and British Xylonite 5 per cent. preference changed hands around 24s. 6d.

Various iron, steel, and kindred shares continued to attract attention, partly on yield considerations. Tube Investments at 95s. 6d. held virtually all their recent rise, as did Stewarts & Lloyds deferred at 53s. 9d. Dorman Long were 28s. 7½d., Guest Keen 33s. 9d., and United Steel 24s. 3d. Staveley ordinary moved up from 49s. 3d. to 50s. 3d., and Consett Iron 5s. ordinary strengthened to 7s. 4½d. Monsanto Chemicals 5½ per cent. preference were

23s. 6d. Morgan Crucible 5 per cent. preference were 24s., and the 5½ per cent. preference 27s. Forster's Glass 10s. ordinary improved from 30s. to 31s. 3d., at which the yield is 4¾ per cent. on the basis of last year's 15 per cent. distribution. Canning Town Glass 5s. ordinary were 8s. 7½d. In response to hopes of the results showing good improvement, British Indestructo Glass 2s. ordinary moved higher to 4s. 6d. Blythe Colour 4s. ordinary remained around 9s., and Goodlass Wall 10s. ordinary at 16s. 10½d. General Refractories at 16s. 10½d. were virtually the same as a week ago. Leeds Fireclay ordinary were 7s. 6d. and the preference shares 18s. 6d.

Lever & Unilever ordinary were among numerous shares which continued to be influenced more by hopes of recovery in dividends after the war than by the immediate dividend yield, and were maintained at 36s. 6d. Elsewhere, Barry & Staines became firmer at 44s., and Nairn & Greenwich were steady at 70s. An improvement from 40s. to 40s. 6d. was recorded in Dunlop Rubber. Boots Drug 5s. ordinary were 42s.; no change is expected in the forthcoming interim dividend. Timothy Whites eased to 32s. 9d., and Sangers were 23s. 10½d. Among oil shares, Burmah Oil were 80s. compared with 80s. 7½d. a week ago, "Shell" 76s. 10½d. compared with 77s. 6d., and Anglo-Iranian 110s. 7½d. compared with 111s. 3d.

British Chemical Prices

Market Reports

TRADING conditions in chemicals on the London market have been steady during the past week, and fresh buying has been on a moderate scale, with values on a strong basis throughout the market. There has been a steady call for contract supplies of the leading heavies by industrial users, and consumption of a wide range of materials has been on a fair scale. In the soda products market, fair quantities of nitrate of soda are being taken up, while good quantities of caustic soda are being absorbed against contracts. A steady demand is reported for Glauber salt and salt cake, and supplies of chlorate of soda are being readily taken up. Percarbonate of soda is steady. Among the potash chemicals, buying interest in permanganate of potash is fairly active, and contracts in both the pharmaceutical and technical grades are being steadily drawn against. Offers of yellow prussiate of potash continue scarce, and a strong price position is maintained. A steady demand is reported for caustic potash at the official levels, while a good demand is reported for bichromate of potash and acid phosphate. In other directions glycerine is a good feature, and there is a sustained activity in white powdered arsenic and alum lump. In the coal-tar products market, contract deliveries of most descriptions of coal-tar products have been steadily maintained, and fair quantities of pitch are being taken up on the home market. All grades of creosote oil are finding a ready outlet, while a tight supply position in respect of the anthracene oils continues to be reported. The pyridines are meeting with a moderate demand, and a good trade is passing in the xylols, toluols and benzols.

MANCHESTER.—Sellers on the Manchester chemical market during the past week have indicated that contract commitments in the general run of heavy products have been drawn against steadily by the textile bleaching, dyeing and finishing trades, and also by the other leading industrial users. A certain amount of new inquiry has been in the market, and this has resulted in a moderate volume of actual fresh business. Prices are firm in almost all departments, and future changes will be towards higher levels. So far as the by-products are concerned, there is a generally brisk movement of supplies in both the light and heavy classes.

GLASGOW.—In the Scottish heavy chemical trade there has been an improvement for home business during the past week. Export business remains rather restricted, and prices continue very firm.

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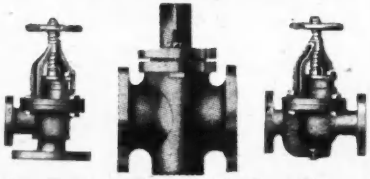

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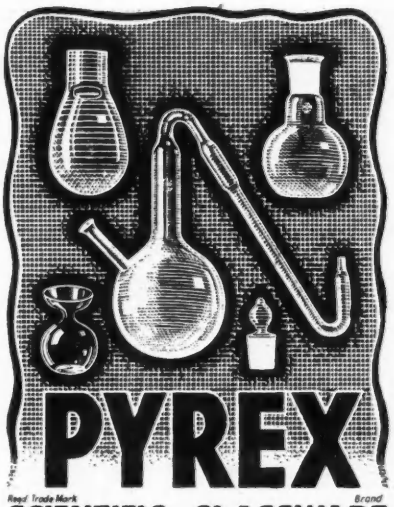

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